ENGINEERING LITERATURE

M. N. Baker, Editor

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The problem of obtaining an adequate supply of laborers in tropical countries which are being developed by outside peoples is often perplexing, particularly where any marked consideration of humanitarian principles exists. An interesting "History of Contract Labor in the Hawaiian Islands," by Katharin Coman, has just been issued (Vol. IV., No. 3, Third Series, Publications of the American Economic Association). Contract labor was authorized by the legislative assembly in 1850, and was abolished after the United States obtained possession of Hawaii. But a report made by labor commission, in 1895, declared:

> It is generally conceded by planters, in these islands, and elsewhere, that the system of wage-paying is the least satisfactory of any of the forms of labor employment, because as the wages are the same, it does not stimulate the ambition of the laborer, and, indeed, tends to reduce the amount of labor furnished by each laborer to the product of the least efficient and most thriftless.

A recent experiment which promises well is the leasing of 50 to 100 acres of land to a "contract company" of laborers, who choose their head man. The planter or owner "furnishes land, seed-cane, water, fertilizer, and tools, and performs such portions of the work as require expensive machinery; he also houses the laborers. The contract-company receives a stipulated percentage on the amount of sugar raised.

The latest aspirant to a place among journals devoted to engineering and engineering construction is "Public Works," an illustrated publication, conducted by the editor of "The Surveyor and Municipal and County Engineer," and published at the St. Bride's Press, 24 Bride Lane, Fleet St., London, E. C., England.

"Public Works," it is announced, will contain "nothing in the nature of news of an ephemeral character," and its articles will each and all be monographic, of world-wide interest, and by contributors "selected from many nations." Certainly this is a promising program. The first number is creditable in point of contents, typography, illustrations, and general make-up.

The City of New York is one of the few, if not the only, city in the United States that publishes a daily paper. "The City Record" appears daily, except legal holidays, and varies in size from a few pages to several hundred, according to the volume of official matter awaiting publication. The transactions of the various departments of the city government, weekly, quarterly and annual reports, a directory of city departments, legal notices of various kinds, and calls for bids for all sorts of materials and contract work appear in its columns.

Particular attention is here called to "The City Record" because the issue for Aug. 12 contains the recent "Report on the New City Hall, or Brooklyn Bridge Terminal," by Mr. G. Lindenthal, Commissioner of Bridges, including a number of plans showing the arrangement of the new terminal tracks (see Eng. News, July 9, 1903, for a reproduction of some of the originals) and large folding plates of architectural drawings of the proposed terminal and lofty "campanile," by Mr. Henry F. Hornbostel and Mr. Geo. B. Post, designing and constructing architects, respectively. "The City Record" is published at the City Hall, New York City, and those sufficiently interested in the full illustrated report can obtain copies there for the modest sum of three cents.

The Japanese are recognized as a progressive and discriminating people. It must therefore give particular pleasure to the author and publishers of Professor Mansfield Merriman's "Elements of Sanitary Engineering" to have a Japanese edition of the book appear. Such an edition was recently published at Tokio. The translator is B. Onuma, principal of the Kogy-okusha Engineering School at Shiba.

Some Rules to Be Observed in Making Indexes.

The engineer who frequently consults the literature of his profession is bound to be impressed with the unsatisfactory nature of the indexes with which the majority of engineering books are provided. It is worth while to inquire briefly into the reasons for this fault. There can be no question but that an index is a very necessary adjunct to any engineering book, and particularly to a work of reference. This being true some effort is certainly warranted to make sure that the index which is provided performs successfully its proper function. Writers of engineering books are not likely to dispute these propositions, although they may fail to satisfy fully their requirements, and we can, therefore, dismiss this phase of our subject and turn our inquiry at once to the following questions: What constitutes a good index? What are the causes of the faults in many existing indexes?

In discussing these questions some years ago in Engineering News* it was pointed out that most of the faults of indexing were due to lack of classification and to the selection of key words on the basis of the fundamental idea of the topic. It seems desirable to repeat here in brief form some of the remarks made in our former discussion of these two general principles of indexing.

What constitutes a good index? According to the definition given by the Century Dictionary, an index is:

> A detailed alphabetic (or, rarely, classified) list of table of figures, names of persons, places, etc., treated or mentioned in a book or a series of books, pointing out their exact positions in the volume.

In the original Latin the word index meant a discoverer, informer, indicator or that which points out, hence, particularly, the index finger. It is perhaps the fault of the definition just quoted that it does not emphasize a little more the distinctive office of indicator or pointer-out, which the index to a book occupies. A better definition in this respect would be the following: An index is an alphabetic list of catch words or key words of the topics, persons, places, etc., mentioned in a book, with numerical references to the exact position of these topics, names, places, etc., in its pages.

Neither of these definitions, as a matter of fact, expresses fully the exact nature of a good book index. Nearly all topics are divided into subtopics, and these are divided again into minor topics. In the best form of indexes only the key words of the main topics are arranged alphabetically with reference to the index as a whole, those of each sub-topic being arranged under its proper main topic in alphabetical sequence in respect to themselves alone. This subdivision of alphabetic lists may be extended to any degree which the nature of the topics makes desirable. In other words, the element of classification as well as that of alphabetic arrangement, enters into the selection of the key words, which, with their proper modifying and qualifying words and page references constitute an index.

Keeping alphabetic arrangement and classification in mind, the first duty of an indexer having a number of topics, reference to which is desirable, is to select for each of these topics a key word which a person wishing to refer to that particular topic is most likely to think of and seek. This is evidently in many cases purely a matter of judgment, and it is the difficulty of judging exactly what word another person will think of in any particular case which makes necessary cross-indexing and cross-reference, which are explained further on. Although the selection of key words is not a process which rules alone can direct, it is evident from what has been said that there are certain general rules governing this work which the indexer should strive to follow.

A modifying or qualifying word is seldom if ever suitable for a key word. Such words as assumed, best, character and nature, belong to this class, and their uselessness as key words may be seen from a single illustration. Let us assume that the topic to be indexed is a discussion of the character of flange section for plate girders. Now a person desiring to find this discussion would be no more likely to look under "character" than he would under, say, "composition" of flange section, "make-up" of flange section, "design" of flange section, either of which would express the topic indexed quite as accurately as "character." The preceding rule is a very elementary one, but it is violated with surprising frequency in book indexes.

The fundamental idea of a topic is not a criterion for the selection of the key word by which to index it. Instead the thought should be first of the classification under which the word properly comes, and second what position in this classification the topic occupies; that is, whether it belongs to the main topic or is a part of the sub-topic under a main topic. The reason for this is of course that ideas cannot be alphabetized; only words are susceptible to this form of arrangement. Hence the position of any particular idea in an alphabetic list is determined by the sequence of words employed to express that idea; one arrangement of words may place it near the beginning of the alphabet, while another will place it toward the end, and the reader has nothing upon which to base his judgment as to where it will be found. If, however, we first classify the ideas we wish to make reference to into main and sub-classes proceeding from the general to the particular, we finally limit the field in which the idea may be located so that it can be found easily and certainly.

To illustrate, let us assume that the topic we wish to index is "assumed uplift for swing-spans." The fundamental idea is uplift or end-uplift and either might be selected as a key word if we adopt the rule that the fundamental idea of a topic is the criterion for the selection of the key word by which to index the topic. If "uplift" is chosen its alphabetic position is at the end of the index, and if end-uplift is chosen that position is near the beginning of the index. If, however, we consider the classification of the idea we should place "uplift" as a minor topic under the sub-topic "swing spans" under the main topic "drawbridges."

The question may now be asked, would a reader desiring to look up "assumed uplift of swing spans" be likely to think of searching for it under "drawbridges." There are reasons for thinking

*Engineering News, April 23, 1896.

that he would. "Uplift" in its special meaning here is peculiar to swing spans alone, and as a reader would have swing spans only in mind, and never fixed spans, lift spans or bascule spans, when seeking information respecting "uplift," "swing spans" seems at least as desirable a key word as "uplift." The reason for placing swing spans as a sub-topic under drawbridges is that a swing span is only one of several forms of drawbridges. It might, however, be made a main topic itself and certainly would be, were the book being indexed a treatise on drawbridges alone.

It may be accepted as a cardinal rule of good indexing that if a key word is used at all then every possible reference under that head should be included. The force of this rule will be appreciated if we assume that a person wishes to look up all that a book has to say on swing bridges. His natural course would be to look under "swing spans" in the index and consult every reference he found there. If uplift were not included in these references he would miss this important item altogether unless he run upon it by chance in consulting some of the other topics referred to.

Undoubtedly "uplift" is also a possible key word for this topic, and one which under certain circumstances might be thought of by a reader rather than "swing spans." It is advisable, therefore, to cross-index the topic under "uplift," unless it should happen to be divided into several sub-topics when the key word uplift should be made merely a cross-reference to "swing spans," under which would be found for the reasons already stated a full detailed index of uplift, and all its sub-topics. In such a use it will be seen that a cross-reference saves space by avoiding a lengthy repetition. Were there no sub-topics under uplift, then cross-reference, instead of cross-indexing would be a fault because it would necessitate the reader making another search to find nothing additional but the page number, which might have just as well been given him at once.

The preceding injunctions respecting the necessity of keeping classification of topics in mind in selecting the key words for indexing them do not constitute the whole problem of making an index, but they do embody certain cardinal principles of good indexing whose neglect is the chief reason for many of the poor indexes with which engineering books are provided, and whose careful observance will simplify very much the labor of anyone who has an index to make.

CORRESPONDENCE.

The Proposed History of Engineering.

Sir: The recent suggestion of Mr. J. A. L. Waddell, as to a "History of Engineering," is one that should receive the attention of all interested in the profession. (See Supplement for July 16.) The writer has recently had occasion to look up facts in connection with the lives of eminent engineers, and, outside of the memoirs published in the Transactions of the American Society of Civil Engineers, and the short and unsatisfactory sketches in the encyclopedias, there is almost an absolute dearth of matter pertaining to the history of engineering. This is no doubt due, in a large degree, to the proverbial modesty of engineers, as well as to the spirit of the inscription in St. Paul's, London: "Si monumentum requiris, circumspice," which seems to pervade the profession.

While the lives of the poets, dramatists, military and naval heroes of history are familiar to every school boy, how many engineers are there, and especially young engineers, can tell who designed the Washington Monument and great public buildings in Washington, the great bridges at Niagara Falls, the Arequipa Viaduct and Aguà de Verrugas Bridge in South America; or who could give leading facts in the lives of Edison, Eads, Ericsson, Casey, Latrobe, Q. A. Gillmore, Morse, Mills, Trautwine, Renwick, and the host of others whose labors have done so much for the elevation of their profession and the uplifting of mankind? There is no profession that has more of the wonderful and romantic, as well as the heroic, than that of the engineer. The words of the gallant young Shaler, fatally injured in the Park Ave. Subway, "Let the work go on," deserve a place in history with the immortal words of the heroic Lawrence on the bloody decks of the "Chesapeake," "Don't give up the ship!"

My suggestion is to have a Biographical Dictionary of Engineers (civil, military, marine, mechanical, electrical) and Architects, with sketches of the lives and works of all the eminent engineers and architects from the earliest times to the present day. Thus, a sketch of Eads would include a description of the St. Louis bridge and his Mississippi River projects; of Edison, his marvelous electrical inventions; of Renwick, his Grace Church and St. Patrick's Cathedral; of Lindenthal, his Manhattan Bridge with eye-bar cables; and I have no doubt but that a sketch of the experiences and works of Mr. Waddell would prove reading of the most interesting and instructive character.

At the end would be appended historical sketches of the great engineering schools of the world: West Point, Cornell, Columbia, the Ecole Polytechnique, etc., with their courses of study. It might be well to have sketches also of the great engineering societies, with descriptions of their libraries, and philosophical researches.

A work of this kind would not be an encyclopedia of engineering, but by making the lives of the engineers the principal features, the historical part would dominate the technical. Such a work ought easily to be embraced in two quarto volumes, and its price ought not to exceed $10 at the utmost.

It could readily be used as a text-book in scientific schools and would be an invaluable addition to every library in the world. Very respectfully yours,

William S. Root.

Engineering Dept., N. Y. C. & H. R. R. R., New York City, July 18, 1903.

Sir: I read with much interest Mr. Waddell's paper on the "History of Engineering," and the editorial comments on the same in the Engineering Literature Supplement of July 16, 1903.

Having had occasion some time ago to deliver an address on "The History of Civil Engineering," I was impressed, during my researches, with the deplorable lack of any literature on this subject. There is practically nothing of this nature to which the engineer can turn. He must pick up a little here, gather some there, and finally arrive at the facts with an amount of labor generally out of all proportion to the importance of the matter in hand. The only reason I can assign for this lack of literature is that civil engineers are eminently practical men, and, unfortunate as it undoubtedly is, have no time, and often no inclination, to turn to the finer and more polished side of life.

I would like to make a few suggestions as to the actual work proposed. If the undertaking is to result in anything like success, it seems to me impossible to confine it to one volume. The topics mentioned by Mr. Waddell would easily fill five or six volumes, even if treated in a carefully condensed form. (I take it for granted that each subject will be treated of from the earliest times to the present day.) I have in mind now several special histories in other lines, filling from six to twenty volumes each. Surely the oldest and grandest profession in the world should have its history, which would be on a par with any other.

As for the final board of supervising editors, it seems to be the only practical way to conduct such a vast undertaking. Members of the profession who contribute would have to expect some such arrangement. There should certainly be enough *esprit de corps* among us to sacrifice personal ideas or desires for the general result.

Finally, I can only say that I sincerely hope the work will be undertaken, and I think it would secure the hearty support and co-operation of all branches of the profession.

Yours very truly, J. H. Gandolfo, C. E.

142 West 105th St., New York City.

(The title of the paper by Mr. Waddell which gave rise to this discussion was "The Advisability of Instructing Engineering Students in the History of the Engineering Profession." On the editorial page of this Supplement for July 16, it was suggested that the undertaking, if entered upon, was in danger of becoming "a collection of histories of many branches of engineering, and an assemblage of engineering biographies," or else a cyclopedia of engineering. The first of the foregoing letters advocates a biographical dictionary; the second certainly involves a work altogether too extensive for a student's text-book. An encyclopedia of engineering would naturallly include pretty full biographies of engineers; architects have already been cared for, though briefly, in the "Dictionary of Architecture and Building," reviewed in this Supplement for Dec. 18, 1902. Mr. Waddell's paper and the discussion thereof at Niagara Falls (Eng. News, July 9, 1903, p. 35), together with the foregoing letters, indicate a demand for an addition to engineering literature, be it a text-book, a history, a series of biographies, or an encyclopedia. It is not yet clear which is most in demand, but it is certain that the practicable limits of a text-book will exclude the full treatment contemplated by some who have taken part in the discussion. It is questionable whether an adequate text-book can be prepared until some more extended work has been published, or the material for it collected.—Ed.)

A New Work on Hydraulics.

Reviewed by Geo. W. Rafter,* M. Am. Soc. C. E.

HYDRAULICS WITH WORKING TABLES.—By E. S. Bellasis, M. Inst. C. E., Executive Engineer in the Irrigation Branch of the Public Works Department of India. London: Rivingtons, 34 King St., Covent Garden. 1903. Cloth; 6×9 ins.; pp. xii.+303; 108 cuts. $6.40.

The present work is a modest attempt to set forth some of the more important advances of recent hydraulics. As stated in the preface, a new treatise was required in order to include the advances made by Bazin on weirs, by Kennedy on the power of streams to carry suspended matter, and by several American engineers on the flow in pipes and through apertures. A new work was also needed in order to develop and expand the theory of flow in open channels. Mr. Bellasis has, in general, performed the work which he set out to do in a creditable manner, although the book is marred by the introduction of certain controversial matters which were better omitted. Even though one is right it is not desirable to introduce such in a formal text-book. They are preferably discussed in the professional paper or in the columns of a technical journal. There are certain omissions—some of which will be noted—which detract somewhat from the book. Nevertheless, Mr. Bellasis has written a useful book which ought to be in the library of every working engineer who keeps up with the advances in knowledge of this specialty.

An interesting section is that relating to movement of solids by a stream. Broadly, the discussion of this subject is lucid, is indeed—aside from the original papers—the best the writer has seen. Still there is rather an important omission. Although the section begins with a statement of Arey's law, nothing appears to indicate the authorship. On this point one cannot but think that a technical writer ought to be familiar enough with his subject to know the derivation of every material fact or theory and to give proper credit, and while this entails some work, it nevertheless insures against such criticism as is now made of Mr. Bellasis' book. There are a number of similar omissions.

Mr. Bellasis is, however, well-informed, as is shown not only by the present work, but by a number of publications in the Professional Papers on Indian Engineering, and the omissions are very likely due to an overestimate of the importance of brevity. First of all, what is wanted is explicitness, and provided a person has something to say, if it takes fifty pages to express one's views clearly, then fifty pages should be used. There is no special merit in so condensing the fifty pages as to render the author's meaning uncertain. In this matter Mr. Bellasis' sin is in effect the sin of most persons who have written on hydraulics, and he may console himself with the thought that he is in goodly company.

In Chap. III., 38 pages are devoted to flow through orifices, but no mention is made of the work of Thrupp, although this author deduced principles which reconcile many conflicting experiments on orifices.

In Chap. IV., 40 pages are devoted to the weir. Much of this is valuable, but due to excessive condensation, Bazin's work is not presented with sufficient fullness to make it perfectly clear in all its parts. Indeed, only a hydraulic expert can appreciate the significance of some of the tables accompanying this section. On p. 83 the author gives a table of the chief experiments on weirs, from which it appears that the greatest length of weir is 19 ft., over which the extreme depth of flow is 1.6 ft., and yet aside from flow in sewers only rarely does the engineer need to consider so small a flow as this. Or if this statement may be questioned it is at any rate true that in gaging the large streams of this country and India, much larger wiers than 19 ft. long and much deeper flows than 1.6 ft. are constantly required. Fteley and Stearns made ten experiments on a weir 19 ft. long, while Mr. Francis made 65 experiments on weirs 10 ft. long and with an extreme depth of 1.6 ft. Bazin made 295 experiments on a weir 6.56 ft. long, with a maximum depth of 1 ft.; 38 experiments on weirs 3.28 ft. long, with a maxi-

*Rochester, N. Y.

mum depth of 1.3 ft.; and 48 experiments on weirs 1.64 ft. long, with a maximum depth of 1.8 ft. All these weirs, except, perhaps, the 19-ft. weir of Fteley and Stearns, were in effect on a Lilliputian scale, as indeed have been a very large proportion of the experiments not only on weirs, but also on orifices, pipes, etc. Working with small quantities of water engineers have lost sight of the fundamental principles of hydraulics and in pursuit of four decimal accuracy have overlooked the fact that 50,000 cu. ft. of water per second flowing over a weir are likely to bring into play a multitude of forces not manifested when only 10 to 50 ft. are flowing. Failure to recognize such pertinent facts is another defect in the book.

Mr. Bellasis points out that m, in the weir formula as used by Bazin, is equivalent to ⅔ c, as used by most authors, and that c is the true coefficient expressing the relation between the actual and the theoretical discharge. He therefore preferably uses c in the formulas and tables. Aside from Downing's Hydraulics the writer does not remember to have seen this fact clearly brought out, although a good deal of the mystery surrounding the weir has been due to uncertainty on this point.

In Chap. V., on pipes, the large amount of recent work on built-up steel pipes and the modification of views as to coefficient which has resulted from their discussion is entirely overlooked, probably because Mr. Bellasis has not been called upon to deal with such constructions in his own work. Nor are wood pipes mentioned.

In Chaps. VI. and VII., on flow in open channels, Mr. Bellasis is more at home, although even here the discussion is not as complete as could be desired.

In Chap. VIII., the methods of hydraulic observations are discussed and the more important principles to be observed are laid down. In the section relating to piezometers Mr. Bellasis dismisses the pressure gage for recording height of water with the remark that it is not accurate enough. The precautions to be observed with tubes and pipes are briefly pointed out. Differential gages are referred to and the fact that such gages require calibration is noted. The fact that slope observations require a pair of either gage-wells or piezometers which shall be exactly similar is also mentioned.

As might be expected in a work coming from India, the experiments of Captain Allen Cunningham are extensively discussed. This author experimented with floats of various patterns and defined the limits of accuracy. The float experiments of James B. Francis are referred to.

The book has a number of hydraulic tables, some of which will prove of value to the working engineer. The cuts throughout the work are excellent and serve to illuminate the facts and theories discussed. Unfortunately the book is without an index, although the table of contents is good.

From one-half to two-thirds of all the references in this work are to American books and to the Transactions of the American Society of Civil Engineers, etc. Such facts emphasize the active part taken by American engineers in the recent advances and may be the cause of a very slight amount of self-congratulation.

On the whole, this is a very good work, although marred by the defects noted, which nevertheless do not materially detract from its utility to working engineers. The considerable number of omissions merely emphasize that he who would know everything must be a man of many books.

Through an oversight an omission occurred in each of two book reviews published in this Supplement for July 16. In the heading of the Notice of Robinson's "Gas and Petroleum Engines" it should have stated that the book is published in two volumes, at $8.50, by Spon & Chamberlain, New York City, and it should also have been stated that Gillette's "Earthwork and Its Cost" is published by the Engineering News Publishing Co., New York City. In the same issue the address of Mr. E. L. Corthell was wrongly given; it should have been 1 Nassau St., New York City.

A Practical Book on Electric Power and Lighting.

ELECTRICAL ENGINEERING.—An Elementary Text-Book Suitable for Persons Employed in the Mechanical and Electrical Trades, for Elementary Students, etc., etc. By E. Rosenberg, Chief Electrical Engineer at Körting Bros., Hanover. Translated by W. W. Haldane Gee and Carl Kinzbrunner, of Manchester, England. New York: John Wiley & Sons. Cloth; 6 × 9 ins.; pp. 267; 263 illustrations. $1.50 net.

The Germans have a very appropriate and convenient pair of terms to designate the two main divisions of applied electricity or electrical engineering. That part of the art which deals primarily with the utilization of the power of electric currents and hence has to consider only currents of appreciable volume and considerable pressure—using the ampere, the volt and the watt and kilowatt in its measurements—is called by the collective name "Starkstrom-Technik," and all its plant, wiring and installations are called "Starkstrom-Anlagen." Other applications, such as telephone and telegraph working, signaling, etc., are considered under the heading "Schwachstrom-Technik," the term being based on the fact that here the amount of power involved is indeed small, usually so small as to be negligible; the milliampere is the measure of current-strength. This bisection of the field of electrical engineering is so fitting and convenient that it is a pity the English language has no terms by which to make a similar distinction. Now the title of the German original of Messrs. Gee and Kinzbrunner's translation is "Elektrische Starkstrom-Technik," while through lack of an English equivalent for this they have been obliged to entitle their work "Electrical Engineering." This obliteration from the title of a clear and concise delimitation of the book's scope is a distinct loss.

We mention this fact only in order to emphasize, by contrast, the excellence of the book as a whole. There has been a gap in electrical literature, between the text-books or treatises on the one hand and the "popular" books on the other. The book of Mr. Rosenberg, made available to English-speaking people by this translation, is of the kind needed to fill that gap. It is written by a practical man, and its objective point is neither the grammar-school boy nor the lay-reader, a lawyer for instance, but the man who wishes to reach a working familiarity with electrical machinery ("Starkstrom" machinery) without having to go via dynamo design. It will be apparent that the book should serve a large class of readers.

It will not be necessary here to list in detail what the book contains, but a general statement will suffice. The book begins quite at the elements, with a brief exposition of the phenomena through which the electric current (as produced by a primary battery) manifests itself. Leading up thence through magnets and measuring instruments (the ammeter, etc., but not the tangent galvanometer or the Wheatstone bridge) the text comes to the dynamo and later to the motor, then touches on accumulators (avoiding all chemistry or theory) and considers electric lighting (with reference to its mechanism). The last third deals with alternating currents and their machinery and accessory apparatus. All this field is covered by text-matter, diagrams drawings and views, without any algebra or mathematical theory. True, a simple algebraic expression is given for Ohm's law, but only as a summary of a full explanation preceding. Even polyphase machinery is explained on the same basis of ordinary reasoning as is the elementary portion.

The value of the book lies in its "practicalness." The author first makes quite clear how any given machine, say a shunt motor, is constructed, and how this construction affects its running, as regards applicability to different purposes. But he goes farther, he tells how speed, voltage, load, torque, etc., vary, a matter that in text-books is usually passed over by showing a chart of characteristic curves; even farther than this, he points out what troubles may arise from reversed connections, how a machine will behave under special conditions (as when the starting resistance of a shunt motor is outside of the shunt winding), how to throw dynamos into parallel, etc., all of which is information that is of the greatest value to the reader seeking after working information, but that the writers of books have generally left out.

In translating the book into English, Messrs. Gee and Kinzbrunner have also translated the illustrations, not only by re-lettering all diagrams, but also by replacing many of the views of continental machines with views of English apparatus. American work is not represented in the views (with one or two exceptions), but this has practically no effect on the value of the book to American readers, because the text does not describe "systems" or localized methods but general principles and forms of construction.

Five Government Bulletins on Timber Tests and Timber Preservation.

In view of the very recent publication of a new bulletin (No. 41) on the "Seasoning of Timber," it seems desirable to call attention to the splendid work on timber, done by the Forestry Division of the U. S. Department of Agriculture.

Many of our readers will recall the publication of the preliminary report (Bulletin No. 6), in 1892, wherein Mr. B. E. Fernow, then Chief of the Forestry Division, set forth the scope of the investigations that had been begun. Due to lack of sufficient appropriations timber testing has progressed slowly, but with results that have fully justified the expenditures. There are before us five bulletins, varying in size and in matter contained, the contents of all of which it is our purpose to briefly indicate, dwelling more at length upon the recently issued bulletin on timber seasoning.

Bulletin No. 6 contains a historical review of timber tests and a good bibliography of the same. Then comes a description of the methods of tests and of a special testing machine, by the late Prof. J. B. Johnson. Two diagrams (after Bauschinger), are given, showing the relation of strength to moisture percentage.

In Bulletin No. 8 these two diagrams (after Bauschinger) are reprinted; also some exceedingly valuable diagrams and tables of tests made under Professor Johnson's direction. To the engineer who is using timber, these tables and diagrams are of great value.

In Bulletin No. 10 the characteristics and properties of wood are discussed, and a list is given of the more important woods of the United States. In addition there is a key to their determination. The author of this excellent bulletin is Mr. Filibert Roth.

Bulletin No. 12 treats of the Economic Designing of Timber Trestle Bridges. Mr. A. L. Johnson here presents some new designs for timber trestles in which different kinds of material are recommended for different parts. One design shows stringers of yellow pine, corbels, sills and caps of white oak, and posts of red cypress. Mr. Johnson argues that by using such designs it will be possible to save millions of dollars in trestle building in this country. Mr. Walter G. Berg, Principal Assistant Engineer, Lehigh Valley R. R., takes issue with Mr. Johnson, and says that it is impracticable to carry in stock a variety of trestle timber of different sizes. He criticises Mr. Johnson's recommendation of 9 × 9-in. posts in place of the ordinary 12 × 12-in. posts on the ground, for since the failure of a post would be absolutely disastrous, it is false economy to cut down the size, particularly in view of the fact that certain sticks will rot before others.

Mr. Gustav Lindenthal was also asked to review Mr. Johnson's designs, which, however, he does not criticise except on minor points, but presents instead designs of his own.

We are inclined to agree with Mr. Berg on most of the arguments presented by him in favor of uniformity in sizes and uniformity in material. It is quite true that the pines have slight strength against compression sidewise, but even when cutting into the fibers does take place it does not follow that the trestle is in danger of failure. Mr. Johnson's use of 9 × 9-in. posts is one to be commended where the trestle or falsework is of so temporary a nature that it will be removed before rotting can take place. We often see huge 12 × 12-in. posts used in trestles that are to be removed in a few months or even in a few weeks. There, assuredly, it is the part of true economy to reduce the sizes of posts to the lowest limit consistent with safety.

In Bulletin No. 41, "The Seasoning of Timber" is discussed by Mr. Hermann Von Schrenk, assisted by Reynolds Hill. This 48-page pamphlet is the latest contribution to our knowledge of timber physics, and it is in every way an excellent contribution.

Timber seasoning is intended to increase the life of both untreated and treated timber, and it forms at the same time the most important step in successful chemical treatment. The cost of so doing is insignificant, while the returns amount to a considerable sum in the end; and the increasing cost and scarcity of timber demand that every step leading to the more economic use of our present supply should receive close attention.

While experiments are not sufficiently extended to lead to final conclusions, the following general recommendations are confidently made by the authors of the report: Green timber should be piled in as open piles as possible as soon as it is cut, and kept so until it is air-dry, and no timber should be treated until it is air-dry. In the second place, timber treated with a preservative dissolved in water should be piled after treatment for several months at least, to allow the water pressed into the wood with the salt to evaporate. And under no circumstances should timber freshly treated with a water solution be exposed to weathering conditions.

The report itself—which should be secured by those interested—discusses the distribution of water in the wood and in the tree, the relation of water to the decay of timber, what seasoning really means, etc. The bulk of the report is devoted to seasoning and preservative methods, especially those connected with the use of pine ties variously treated. Among other advantages resulting from seasoning mentioned are a saving in freight charges due to a decrease of 35% to 40% in weight, and the possibility of substituting low-grade timbers for better timber now in use. The lower grades of wood, such as Loblolly Pine and Red Oak, have a higher percentage of sapwood and can be penetrated by a treating fluid much more readily than the denser woods, such as Longleaf Pine or White Oak. On account of the greater porosity it is much more economical to treat the porous timber thoroughly with a good preservative than to treat the more expensive and denser wood with a cheaper preservative; and the well-treated cheaper wood will outlast the other in every case. But one of the first steps in making short-lived timber fit for treatment is a proper seasoning. Improper seasoning causes checking and splitting, and uneven drying can be prevented by careful piling. Piling tests were carefully made with various woods, and the report presents the methods and results in detail. For cross-ties, the plan recommended is an open pile, or open-crib pile, with the air circulating freely on all sides, and the ties piled in alternate layers, seven one way and two the other. These piles are built to such a height that men can easily place the ties in position from the grounds. It takes no longer to pile ties in open than in solid piles; the chief item to be considered is the increased yard-room required, and where land is cheap this does not amount to much. Experiments already made show conclusively that in three months the loss in moisture was over 6% greater in open-crib piles of Lodge Pole Pine than where the same timber was piled in solid piles; and at the end of the first month, the loss was nearly 12% greater in the case of the open crib. Tests are being continued in the seasoning of telephone poles and the pine timber used in the Southern states. In the latter case green timber in the woods or in piles is rapidly attacked by wood-destroying fungi, particularly during warm weather, and it may prove that piling methods successfully used in the North will not give successful results in the South.

THE MANUAL OF STATISTICS SUPPLEMENT.—Vol. I., No. 1, July, 1903. New York: The Manual of Statistics Co. Paper; 5 × 8 ins.; pp. 1,045-1,131. 50 cts., or $5 a year.

The Manual itself consists of information designed for investors and dealers in various securities. The Supplement contains additions and corrections made necessary by rapid changes in securities; it also contains some general editorial reviews. A handy binder suitable for a year's numbers, uniform with the Manual, has been perfected.

Modern Locomotive Practice in England.

MODERN LOCOMOTIVE PRACTICE.—A Treatise on the Design, Construction, and Working of Steam Locomotives. By C. E. Wolff, B. Sc., Assoc. M. Inst. C. E. Manchester, Eng.: The Scientific Publishing Co. Cloth, 6 × 9 ins.; pp. 267; 150 illustrations and 8 folding plates. $4.20.

This book is both descriptive and analytical, including descriptions of engines and their detail parts, and also mathematical discussions of valve gear and counterbalancing, the strength of connecting rods, etc. It relates exclusively to English practice, but we judge it to be one of the best and most-up-to-date of English works. It deals with construction entirely, and has little or nothing to say about the train service or traffic conditions of service.

The author wisely abstains from any historical discussion, but in his introduction he first calls attention to the severe conditions governing locomotive design and service. He then takes up train resistance, giving the formulas of Clarke, Laborlette and Deeley, and also one of his own, which is said to hold true for both low and high speeds. Its results correspond pretty closely with those of the two last-named investigators, but are considerably lower than those of Clarke. This formula is as follows, and is accompanied by a table of resistances in pounds per ton for speeds of 5 to 90 miles per hour, as deduced from all four formulas:

$$R = 3\left[\frac{V+12}{V+3}\right] + \frac{V^2}{300}.$$

Special attention is called to the fact that allowance must be made for the rotary momentum of the wheels and axles, which may be equivalent to increasing the mass about 9%.

The adhesive force is given as about 450 lbs. per ton for engines with large driving wheels and 360 lbs. for freight engines with small wheels. But with wet or greasy rails these values may be reduced 50%, while sanding by a steam jet may raise them 50%. The idea that there is a continuous slip of the engine wheels, when running, is declared to be erroneous and to have been disproved by experiment.

In the description of types of express or fast passenger engines we find a diversity of wheel arrangements, with one and two pairs of driving wheels, but it is rather strange that only a few lines are devoted to the notable six-coupled passenger engines which have been introduced on several British railways within the past few years, English railway men and engineers having long held that engines with six-coupled wheels were not adapted for fast service. Engines with a single pair of driving wheels are said to be now in use on most of the important lines, and to be more economical in fuel than coupled engines, owing to their smooth working. The author advocates the use of the leading truck, but many engines still have a single leading axle, while one road has engines in which the coupled drivers are the leading wheels. Two engines of the Atlantic type are shown, but one is called an Atlantic and the other a ten-wheeled engine. Four-cylinder simple engines on two railways are mentioned, and also two, three and four-cylinder compounds, but compound locomotives are not used to any great extent in England. The author considers that the compound may be a success on fairly level lines, but not on those having heavy grades, while they are best adapted for fast passenger engines and freight engines which make long runs without stops. He says:

> For three or four-cylinder engines to be a financial success, the cost of the coal saved per annum must more than equal the interest on the increased first cost, plus the increased cost of repairs and maintenance.

In freight service, we find engines with six and eight wheels, all coupled, and engines of the mogul and ten-wheel type. The latter is considered the less preferable, the larger wheelbase not being compensated for by any superiority of the four-wheel over the two-wheel truck. A few pages are devoted to tank engines, which are extensively used for passenger, freight and switching service, although in this country their use is limited almost entirely to suburban service on a few roads.

In his chapter on "The Locomotive as a Carriage," the size of wheels and the position of wheels on curves are discussed, following which comes a description of a number of types of English trucks or "bogies," in most of which each wheel has its own spring and there are no equalizers. In one of these, blocks are fitted to limit the swing of the truck, and prevent it from slewing round in case of derailment. The radial axle is considered preferable to the two-wheel truck for English engines, which usually have inside cylinders. The radial axle arrangement is quite extensively used; and a four-wheel radial truck has been tried, but the author considers the latter inferior to the ordinary four-wheel swiveling truck. He prefers cast-steel frames to built-up frames for trucks, and also prefers the swing center to the rigid center truck. He suggests, however, the combination of a rigid center truck with blind tires on the leading drivers. This arrangement was in use some years ago on the New York, New Haven & Hartford R. R., but was abandoned after some derailments had shown it to be an element of danger.

In regard to boilers: Sling stays and vertical staybolts for flat crown sheets are shown, and also the Belpaire construction, but the radial-stay construction is not mentioned. The domes appear to be higher and of less diameter than in American practice, but the author believes the domeless boilers used on some roads to be much less liable to priming. Brass or copper tubes are considered superior to steel tubes, which deteriorate much more rapidly by pitting and corrosion, and are more difficult to keep tight. Iron tubes are not mentioned, nor is the length of tubes discussed, except that in mentioning Mr. Webb's boilers for certain compound engines it is stated that these were 18 ft. 6 ins. long in the barrel, and as it was considered impracticable to use tubes of such length, a combustion chamber was introduced to divide the tubes into two lengths. Tubes up to 20 ft. long are in successful use in this country.

Most English engines have inside cylinders, with valves above, below or between the cylinders; two arrangements of outside cylinders are shown, both of which have the steam chests inside the main plate frames. The ordinary slide valve, double-port Allen or Trick valve, and piston valve are shown. The calculations for connecting and coupling rods are discussed and different forms of main-rod ends are shown. The four-bar type of guides is preferred to the single-bar or double-bar. On the subject of crank axles, it is pointed out that this is one of the most vulnerable and expensive parts of an inside-cylinder engine, and in practice the dimensioning of the axle is usually a matter of "rule-of-thumb." The author predicts that the use of mild-steel axles is only transitory and that nickel steel will be more generally used in future. In wheels, we find a coning or inclination of 1 in 26 for the tread, but one road has used cylindrical driving-wheel tires. The American Master Mechanics' Association standard tire is cylindrical for 1-in. from the fillet and then an inclination of 1-16-in. in 1⅜ ins. (or 1 in 22). The use of the Westinghouse and vacuum brakes is mentioned, and different arrangements of brake rigging are shown in diagram, but many engines are said to be fitted with a steam-driver brake (on account of the small size of brake cylinder required) working in connection with the vacuum brake on the train.

About 70 pages are devoted to link motions and radial and single-eccentric valve gears, and this is one of the most interesting parts of the book. The Stephenson (invented by Howe), Gooch, and Allan straight-link gears are shown, and considerable space is devoted to the design of link motions. The Zeuner mathematical investigations are said to be tedious, inaccurate, and based upon assumptions whose accuracy is undetermined. The Zeuner diagrams are used, however, in the book. In special forms of gear, the Joy naturally comes first and its operation is worked out mathematically. The Walschaert (really invented by Waldegg), Engelmann, Morton and Baguley motions are shown, together with a single eccentric and loose eccentric gear. Several diagrams of certain functions of radial gears are given. Nothing is

said, however, as to the extent to which these various gears are actually used upon locomotives.

Another subject which is worked out analytically by mathematics is that of counterbalancing, but the author minimizes the vertical effects of the balances on the wheels. He states that these will only result in a variation of pressure on the rail, which if too great may tend to shorten the life of tires and cause slipping at high speeds. The serious effects of these vertical forces exerted upon the rails are not referred to. The matter is considered in relation to both inside, outside, horizontal and inclined cylinders, and the advantages of four-cylinder engines in reducing the difficulties of counterbalancing by weights are pointed out.

At the end of the book are 33 pages devoted to examples of modern locomotives, with folding plates of structural drawings of seven engines, all for passenger service, but including an Atlantic type tank engine. In mentioning some of the modern compound engines, the author refers briefly to the Vauclain and tandem four-cylinder compounds used in this country, but remarks that in Europe the opinion is that if the use of four cylinders is adopted it should be in connection with a four-crank arrangement.

There have been numerous books on locomotives published, but many of these are rather popular and descriptive, deficient in the technical portions, and often out of date. It is refreshing to find the subject so well treated and so representative of really modern practice. The book is interesting, even though it treats exclusively of foreign practice. In literary style it is clear and concise. In addition to its technical and literary excellence it have the desirable points of compact and convenient size, which points are a common feature of English technical publications, but are too often overlooked by American publishers of similar works. The diagrams and working drawings are all clear, with clear and legible lettering. The index is fairly complete, but not very systematic.

French Practice in Farm Drainage.

DRAINAGE ET ASSAINISSEMENT AGRICOLE DES TERRES (LAND AND AGRICULTURAL DRAINAGE). By L. Faure. Paris: Ch. Beranger. Cloth; 7 × 10 ins.; pp. 279; 4 folding plates and many illustrations in the text. $3.75.

In his preface the author refers to the work which engineers and technical schools have done within the past few years in applying engineering science to agriculture, and particularly in relieving the soil of surplus water by means of underground channels. In some respects old methods have been greatly modified as a result of such work. For instance, the practice of conducting the drainage in the direction of the steepest grades of the land has been abandoned in favor of the transverse system of drainage. The general systems of drainage, as for reclaiming swamp or other wet lands, and which are undertaken by the State or by large companies, are discussed only in brief. The book deals more especially with the smaller works for improving the condition of farm lands, and which are undertaken by private parties or local companies.

The author first discusses the disadvantages due to excessive moisture in the earth, or in the form of pools or ponds upon its surface. These disadvantages relate in part to public health, and especially to a reduction in the quality and quantity of the agricultural product, not only by the moisture alone, but also by the effect of the moisture in lowering the temperature of the soil. These wet soils are also much more difficult to work. The relation of these various conditions to the chemical and other characteristics of the soil are discussed.

Drainage work of this kind includes: (1) The exclusion of outside waters from the given area; (2) the collection of water which falls upon this area; and (3) the removal of this water by flow in natural or artificial channels or by pumping. The second of these items is the most important, and may be effected by means of open ditches, by covered drains, by bored wells, and by tile or pipe drains. The causes of excessive moisture, either due to surface or underground waters, are discussed, and means described for determining the presence of such excess moisture. A review of the geological conditions of France concludes the first part of the book.

The second part discusses the drainage and improvement of large and small areas of land, and describes the various methods required to suit varying conditions. The direction and capacity of ditches are discussed, and various styles of covered drains are shown, consisting of trenches in which fascines, stones, etc., are laid. The use of such drains, however, is said to be now nearly obsolete. The "Dutch system" of drainage consists in sinking wells through the clayey stratum to a permeable substratum.

These two parts occupy only about one-third of the book, the remainder being devoted to tile drainage. The direction, depth, spacing, grade and diameter are all discussed, and various formulas are given for determining these several functions under different conditions. The series of parallel drains proper usually run transversely to the slope of the ground, while the collectors run with this grade, the junctions of the drains and collectors being preferably at an angle of about 60°. A chapter of 46 pages discusses the execution of the work, including the staking out and excavation of the trenches, the selection and laying of the tile, the refilling of the trenches, and the construction of such accessory work as outlets. Ditching tools are shown, including a special hammer for breaking the tiles to length. It is stated that good tile immersed in water for ten hours should not absorb more than 15% of their weight of water, and there should be no increase in the absorption after that period.

Another chapter discusses the economies incidental to drainage, and this is followed by a chapter on the surveys and preliminary investigations, the specifications, the plans and estimates, and the report required in connection with the application to the authorities for permission to carry out a certain project.

Heating and Ventilating Service.

THE VENTILATION, HEATING, AND MANAGEMENT OF CHURCHES AND PUBLIC BUILDINGS. By J. W. Thomas. London and New York: Longmans, Green & Co. Cloth; 5 × 8 ins.; pp. 140; 25 illustrations. $1.

This little book describes the troubles met with in ventilating and heating churches and other large buildings, and contains the author's suggestions for remedying them, including instructions for "caretakers" as to the management of apparatus. It is written from a British standpoint, and many of the conditions described are not found in the United States. Thus the author states that it is customary, in England, to heat churches and halls in cold weather to about 55° F., before the audience assembles, while in America 70° is nearer the mark. The difficulties experienced in heating and ventilating large audience halls are discussed and illustrated by cuts. The latter are chiefly remarkable in showing how cold air descends from orifices in and near the roof, to the discomfort of the people below.

The author believes in introducing warm air through a number of small openings in or near the floor as the only proper way to ventilate a building. He condemns downward ventilation utterly. To quote:

> During the past century downward ventilation has had a fair trial, for among other places it was tried in the French Chamber of Deputies, under circumstances where monetary considerations did not handicap the system. Wherever it has been tried on a large scale, that failure which common sense, with a knowledge of the physical behavior of gases, predicts, has invariabbly been experienced and yet, even during the opening of the present century, in the pages of the leading engineering and sanitary journals, downward ventilation has been advocated, hence it is not so surprising that the science has made such little progress in the past.

It is evident that the author is not acquainted with heating and ventilating practice in the United States, where downward ventilation has been eminently successful, and indeed has become the favorite system. Although the book has but little relation to the conditions of American practice, it contains much interesting reading, and students of heating and ventilating will find in it many valuable suggestions. The author divides his subject substantially as follows: Physical laws bearing upon churches and public buildings; the action of wind and the effects of moist air upon ventilation; air, air inlets and outlets; how to improve the ventilation of buildings already erected; mechanical and heat-aided ventilation; how to ventilate new buildings; instructions for the caretaker.

Steam Indicators.

THE STAR IMPROVED STEAM ENGINE INDICATOR.—By Geo. H. Barrus, M. Am. Soc. M. E. Boston: Star Brass Mfg. Co. Cloth; 5 × 7 ins.; pp. 140; tables and illustrations. $1.

This book is prepared as an advertisement of the indicator manufactured by the Star Brass Mfg. Co., of Boston, and also as a useful book of reference and instruction in the practical work of indicating. The indicator illustrated in the book appears to be practically a copy of the Thompson, with a few modifications of details. A new feature is a swivel head at the upper end of the piston rod, by which any desired vertical adjustment of the position of the pencil can be secured without removing the cap from the cylinder. The book contains a detailed description of the indicator, and follows it with an illustrated description of a new apparatus used in testing the springs. The indicators are mounted on a steam drum into which steam is admitted at a slowly increasing pressure, which is registered by a mercury column. As the mercury rises it closes an electric circuit at different pressure and thereby causes a mark to be made on the paper on the indicator drum corresponding to each increment of 1, 5 or 10 lbs. of pressure, as desired. The record thus made is repeated after the steam supply is shut off and while the pressure is decreasing. For pressures below atmosphere the testing drum is connected to a vacuum pump.

In addition to this descriptive matter the book contains reproductions of 14 diagrams, taken from as many different engines, and very full and clear directions for indicating engines, and an account of the use of the indicator in setting the valves of an engine. Directions are also given for "working up" diagrams, the use of the planimeter, and computation of horse-power. Chapters follow on steam accounted for by the diagram, cylinder condensation, combining diagrams and leakage tests, and the book concludes with a number of useful tables for computation. On the whole, although the book is intended to advertise a particular make of indicator, it is one of the best brief treatises on the indicating of engines that we have yet seen.

COMPOUND CORLISS ENGINES.—By James Tribe, M. Am. Soc. M. E. Milwaukee: The Author. Leather; 4½ × 7½ ins.; pp. 179; 18 tables and 38 illustrations in the text. $2.50.

This little book is practically a revision, with numerous additions, of the author's earlier "Compound Engines." It is a different sort of book from any other work on the steam engine with which we are acquainted, in that it is chiefly devoted to the solving of problems, by simple arithmetic, of the dimensions of cylinders, terminal and back pressures, expansions, etc., of engines of various powers, and of the single, double, triple and quadruple expansion types. The first 60 pages contain an elementary discussion on heat, fuel, steam and thermodynamics, which is entirely too much condensed to be of value to a student who is not already acquainted with the subject, and who will find the standard treatises on the steam engine better fitted for his needs. Theoretical diagrams are next treated, and here the author does some good original work, although his style is often far from clear, as the following extracts show:

> Page. 67. In constructing a combined diagram, the first thing required is the initial steam pressure, and second the ratio of cylinder areas in keeping with the first.
> Page 68. To locate these points figure first for the ratio of areas, and from them the high pressure terminals, the two must agree.

The remainder of the book contains the method of calculation, with numerous examples, of the dimensions, pressures, and expansions of multiple-expansion engines. Scarcely any theory is given, and there are no algebraic formulas. Printed rules are given for every stage of the calculation, and immediately underneath each rule is a numerical example. Several useful tables are included, by means of which approximate dimensions may be easily determined. Numerous com-

bined diagrams are given, and the student is recommended to lay them out for himself on the drawing board, and also to follow, with pencil and paper, all the examples given.

American Machine Building, and the Factors in its Success, as seen by a German.

DIE AMERIKANISCHE MASCHINEN-INDUSTRIE UND DIE URSACHEN IHRER ERFOLGE.—By Paul Möller. Paper; 9½ × 13 ins.; pp. 14; illustrated. Address the Author, Charlottenstrasse 43, Berlin, N. W., Germany.

The author of this pamphlet made a visit to the United States for the purpose of studying industrial conditions here. The results of his observations were embodied in a paper read before the large German engineering society, the "Verein Deutscher Ingenieure," at its annual meeting, held at Augsburg during the first week of July, 1903. The present pamphlet is a reprint of this paper.

The opinions of a foreign observer of our country and its people are naturally of greater value when that observer has the practical and thorough eye of a trained engineer, as in the present case. Further, Mr. Möller's views seem more fair and correct than much of what foreigners have written about America, because he takes a sympathetic attitude toward our work and our achievements, rather than the attitude of unconscious prejudice which characterizes most European (and particularly the British) visitors to our shores.

Mr. Möller begins his paper with the words:

> The development of industry in America is without a parallel in the history of civilization.

With this as a fact before him, he seeks the causes of this advance; he desires to learn why we have done more in a few decades than older Europe, with its stores of learning and skill, could do in a much longer time. And he further wishes to discover the mechanism of the advance, how we have achieved our national wealth and our strong position in the world's production. All this is indicated in the title, which may be translated, "American Machine-Building, and the Factors in its Success."

The author's answer to his question of cause is not very unexpected or complex. In the first place, the country is enormously rich in natural resources, not least of which is the fertility of its land and the vast crops of food-stuffs produced. This has for many years drawn a steady stream of immigrants, who not only take part in producing but also furnish a rapidly growing market for all kinds of products. A high tariff gave manufacturing industries a free home market which they could exploit without regard to foreign manufacturing conditions. Extensive facilities for internal transportation aided in the development. The absence of tradition and its conservatism, and of specific labor legislation, are named as contributory causes. So much for the "why" as presented by Mr. Möller.

The question of "How" is answered by "Specialization." To this the larger part of the pamphlet is devoted; the author gives numerous examples of how this is exemplified in the industry at large and in any single branch or workshop. This leads to a consideration of the growth of the large "trusts," in whose nature and working (when properly managed) the author finds typical expression of specialization. He sees some advantage for European manufacturers in adopting the system of large combinations of manufacturing concerns, at any rate in those fields in which wholesale production is possible. Much may be gained by them, also, from the general adoption of standardization, interchangeable working, etc. A trial, at least, should be made of premium or similar systems of payment to increase the efficiency of workmen. In general, however, he thinks that a slavish copying of American methods can only be extremely harmful, and after all, he asserts, Germany has made such notable progress in industry, though in the face of every adverse condition, that it has little to fear from "American invasion."

If we should attempt to criticise the author's remarks, we might note one important omission. He speaks in terms of praise of the American workman (though he foretells trouble from the "union" tendencies), and recognizes his large share in our rapid development. But he fails to connect the good qualities of the workman with the general characteristics of the American people, their initiative and independence, resulting from their freedom from the fettering conservatism that is to be found in Europe. The absence of conservatism is, indeed, mentioned as a contributory cause, but its proper importance is unrecognized. In Europe the narrow, crooked streets and mediaeval conditions of life which still exist everywhere but in the few wholly modern cities or districts, are typical of the spirit of the people, their fear of risking loss by any innovation or extension. Similarly, in America, the opposite is typical, and the popular principle is to try new methods, enter new fields of activity, and risk a little for the chance of greater gain.

ROOF FRAMING MADE EASY.—By Owen B. Maginnis, Architect. Second Edition, Revised and Greatly Enlarged. New York: The Industrial Publication Co. Cloth; 6 × 8 ins.; pp. 164; 97 illustrations in the text. $1.

This is a book for the carpenter and builder, and the fact that it is a second and enlarged edition is evidence that it is a book which has met with favor among those for whom it has been written. The framing of timber roofs is, notwithstanding the inexperience of steelwork in large buildings, yet an art which must be counted with by the builder of country houses, and with their often elaborate architectural design nowadays these houses furnish problems in complicated roof framing that require the exercise of no mean engineering skill in their solution. The author starts his consideration of timber roof framing with examples of simple roofs and gradually works up to the most complicated forms of hip and valley work, conical and domed roofs and various combinations of irregular roof forms. In each case directions are given in detail for the work of laying out the framing of the form of roof being considered. These directions are explicit, and are made clear and intelligible, so that any carpenter of ordinary skill and experience may be able to understand and follow them.

ASSOCIATION OF CIVIL ENGINEERS OF CORNELL UNIVERSITY.—Transactions for 1902-3. Ithaca, N. Y.: The Association. Paper; pp. 99; illustrated.

Here are printed four papers by alumni and four by non-resident lecturers. Of the latter, J. E. Greiner spoke on bridge engineering; Elwood Mead on water rights; Kenneth Allen on the Baltimore sewerage investigations, and Frank W. Skinner on fireproof building construction. The alumni papers are: E. J. McCaustland, riveted plates; Ira J. Coe, the Portland cement industry; John C. Trautwine, 3d, some hydraulic resistances, and L. J. Houston, Jr., dynamometer tests on the Canadian Pacific R. R. There is an obituary and a good portrait of the late Prof. E. A. Fuertes, and obituary notes on Ira A. Shaler and others.

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Pattern-Making.

THE ART OF PATTERN-MAKING.—By I. McKim Chase, M. E. New York: John Wiley & Sons. Cloth; 5 x 8 ins.; pp. 254; tables and 215 illustrations in the text. $2.50.

While the title page of this book calls it "a comprehensive treatise," it is in reality more of a collection of short essays on pattern-making and pattern-makers' tools; and,in fact, the author himself says (p. 34) that "The present chapters have not been written with a view to teaching the art of pattern-making, but rather presuppose a knowledge of it." Nevertheless, the book is a most instructive manual on the art of pattern-making.

The author describes in separate chapters the making of patterns for a cylinder, an elbow, a steam cylinder, a pedestal, screw propellers, rifle-projectiles, a launch engine, a water collar, a gun-mount pedestal, a large flywheel, an oblique chute, gear wheels, and belt wheels. There are besides chapters on pattern-shop equipment, shop management, lathe work, useful rules for the shop, practical geometry, etc. Many of the chapters are less than a page long, there being 49 chapters in 250 pages, and this gives a rather scrappy appearance to the text. The real merit of the work lies in the fact that it is based largely on personal observation, and this outweighs such defects as arrangement of matter. Nevertheless, it is to be hoped that the author, in a future edition, will use as much care in the preparation of the whole book as he has evidently used in the preparation of many of its chapters. To this end the rather brief "Introduction" should be expanded into one or more chapters on the art of making patterns from wood; that is, the manual art of shaping and assembling the wood. Chap. XXV. constitutes a page on "Glue and Its Use." In "a comprehensive treatise" this page would be merely one of great number of pages of similar matter forming the first chapters of the book. The chapter on "The Lathe and Lathe Work" instead of being the twenty-eighth chapter in the book should be among the very first, and should be very considerably enlarged—all this, assuming that the author desires to produce a treatise that is logical in arrangement and really "comprehensive."

The author states in his preface that the subjects chosen for illustration were originally written for publication in "Machinery," which in a measure explains what we have already termed the "scrappy" appearance of the text.

CHIMNEY DESIGN AND THEORY.—A Book for Engineers and Architects. By William Wallace Christie, M. Am. Soc. M. E. Second Edition, Revised and Enlarged. New York: D. Van Nostrand Co. Cloth; 6 x 9 ins.; pp. 192; 53 illustrations. $3.

The first edition of Mr. Christie's book appeared in 1899, and was favorably reviewed in Engineering News for July 27 of that year. This edition has been revised throughout and about 25 pages of text and 12 full-page illustrations have been added to it. The new matter, in part, treats of radial brick chimneys, or chimneys in which specially molded radial brick are employed in construction. The advantages claimed are additional stability owing to fewer joints exposed to weathering conditions, and a better bond, owing to the vertical perforations in the brick. Mr. Christie also answers some of the criticisms made by reviewers of his original work.

RADIUM AND OTHER RADIO-ACTIVE SUBSTANCES; Polonium, Actinium and Thorium, with a Consideration of Phosphorescent and Fluorescent Substances, the properties and application of Selenium and the Treatment of Disease by the Ultra-Violet Light. By William J. Hammer, Consulting Electrical Engineer. New York: D. Van Nostrand Co. Cloth; 6 x 9 ins.; pp. 72; illustrated. $1.

This is pp. 541-612 of the Transactions of the American Institute of Electrical Engineers for May, 1903, with the paging changed and a cloth binding added. The printed matter was originally a lecture delivered before the Institute and the American Electrochemical Society in New York City on April 17, 1903. The lecture consisted of an extensive series of notes on the topics indicated by the title and sub-title, accompanied by many lantern slides, which have been reproduced to appear with the text.

DETAIL DRAWINGS of a Four-Furnace, Single-End Scotch Boiler, together with Diagrammatic Pipe and Auxiliary Plan, Used in Connection with a Triple-Expansion Engine, and a 1,250-HP. Triple-Expansion Engine; with Key Naming and Describing Every Part of the Engine. Folding Sheets in Cloth Pocket. Reprinted from and Published by Marine Engineering, New York. $1.

These drawings and diagrams should prove very useful to anyone who wishes to design a boiler or an engine of the types shown, and also to instructors of mechanical drawing. The piping diagram is a model of its kind, and it should be studied by those who are about to design the necessarily complicated system of piping of a modern steam plant. It shows the water and steam connections of a 1,500-HP. triple-expansion engine, boilers, and auxiliary machinery for a freight steamer. The engine drawing has each part numbered, and a clearly-written description gives the name of each part, and explains the action of steam in the engine.

INDEX OF THE TECHNICAL PRESS.—Association de la Presse Technique, 20 Rue de la Chancellerie, Bruxelles. Monthly; 4 x 9 ins.; pp. 195. $1 per year.

This series of indices of matter presented in the technical press of the world is a new Belgian venture, and in its arrangement it promises well. Each item gives the title of the article, a brief explanation, the name of the author, and the name of the journal, its date and the length of the article. These notes are printed on one side of the page only, so that they can be cut out and arranged on index cards. Only three languages—English, French and German—are used; for Italian, Spanish and Russian notes the French is employed, and Scandanavian and Dutch items are indexed in German.

AMERICAN CERAMIC SOCIETY.—Transactions of the Fifth Annual Meeting, held at Boston, Mass., Feb. 2 to 4, 1903. Columbus, O.: The Society, Edward Orton, Jr., Secretary. Paper; 6 x 9 ins.; pp. 430; plates, and illustrations in the text.

Many of the papers in this volume relate directly to ceramic or pottery work, but there are a number of interest to engineers. Among these is the paper on "The Elimination of Hand Labor in Brick Making," by J. P. B. Fiske, which was published in our issue of Jan. 15, 1903. Other papers of interest may be noted as follows: "Recent Investigations in Portland Cement," A. V. Bleininger; "The Department of Clay Working and Ceramics at Rutgers College," Prof. C. W. Parmelee; "The Manufacture of Artificial Sandstone or Sand Brick," Samuel V. Peppel; and "The Work of the Ceramic Engineer in the Brick-Making Industry," W. D. Richardson.

NEW INSTRUMENTS OF PRECISION FROM THE RYERSON PHYSICAL LABORATORY.—By Robert A. Millikan. The University of Chicago Decennial Publications. Chicago: The University of Chicago Press. Paper; 9 x 11 ins.; pp. 8; 6 illustrations in the text. 25 cts.; by mail, 27 cts.

There are described herein certain apparatus devised by members of the department of physics of the institution named, as follows: (1) A substitute for the Atwood machine; (2) a "moment of inertia" machine; (3) a Young's modulus apparatus; (4) a vapor-tension device.

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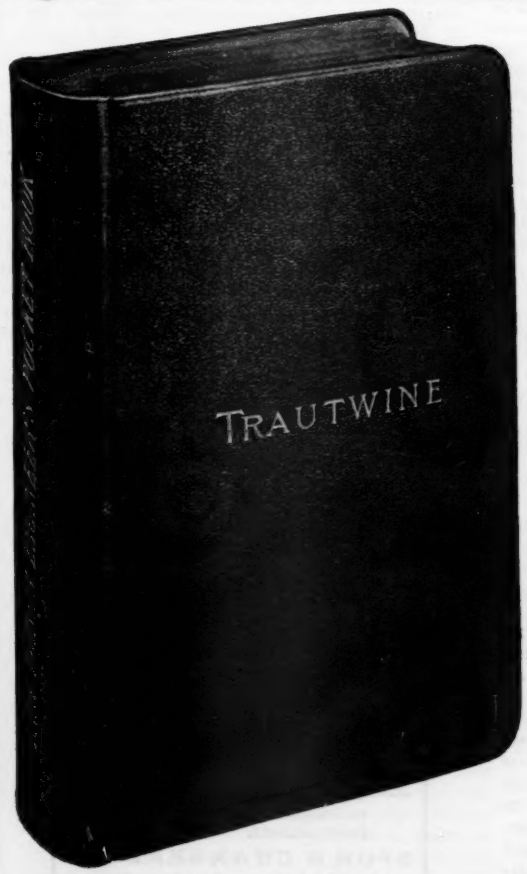

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The Literary Magazines.

As usual at this season, fiction is dominant in the "Century," "Harper's," "Scribner's" and "McClure's," and even the "Atlantic" opens with "a complete novel." In the "Century" there is an article on "Yellowstone Park," by Ray Stannard Baker, and one entitled "An Artist in the Antarctic," by Frank W. Stokes. "Harper's" has an article on "Photographing the Moon," by Ellsworth Kelley.

Three brief articles on hydro-electrical development appear in the "Review of Reviews": "The Harnessed Hudson," by T. Commerford Martin. "Power Development in California," by L. R. Freeman; and "Electric Power from Mt. Rainier." Mr. Martin quotes some interesting figures from the United States Census showing that notwithstanding the recent great water power developments, the percentage of steam power use in manufacturing is far greater than it was in 1870. Some of the illustrations in these three articles tell absolutely nothing except to the engineer, and he might be puzzled to know what they are designed to show were it not for their titles.

The people of the Eastern part of the United States, and at Washington, have taken up the advocacy of forest reservations as a cult, declares James P. Kimball, in the "North American Review." All the material interests affected, says Mr. Kimball, are located in the Western States, and these he proceeds to set forth. He shows how the reservations, and the rules that govern them, hamper and even drive out settlers located in advance of the reserves.

In the British reviews for July there may be noted, in the "Nineteenth Century," an article on "Radium and Its Lessons," by Sir Oliver Lodge, and one on river pollution, by Chas. M. Gaskell, Chairman of the West Riding Rivers Board, 1893-1903. Mr. Gaskell outlines the work of the various river pollution commissions, and conservancy boards. For his own board he says:

> We may claim to have done something to upset the time-honored belief that has existed from the earliest times, that the first function of a stream is to carry filth away into the sea. I always think of Augeas as a paper manufacturer, and of Hercules as the first polluter of rivers.

Mr. Robert Donald's discussion of municipal ownership and allied topics is continued in the "Contemporary Review" under the title, "The Trust or the Town." By trust as here used he means huge combination of capital and of allied industrial interests engaged in supplying such municipal wants as light and power. Mr. Donald draws freely from America for illustrations of the evils, as he sees them, against which he warns his readers. In "The Building of St. Petersburg," Mary F. Johnston tells in the "Fortnightly" how Peter the Great "took a fancy to develop a seaport and finally a new capital, and how the work was carried on, a hundred years ago, at a great cost of money and human life.

WATER SUPPLY AND IRRIGATION PAPERS OF THE U. S. GEOLOGICAL SURVEY.—Chas. D. Walcott, Director; F. H. Newell, Hydrographer in Charge. Washington, D. C.: Pub. Doc. Paper; 6 × 9 ins.

No. 78: Preliminary Report on Artesian Basins in Southwestern Idaho and Southeastern Oregon. By Israel C. Russell. Pp. 58; two plates and three figures in the test.

No. 79: Normal and Polluted Waters in Northeastern United States. By Marshall Ora Leighton. Pp. 192; 148 tables and 17 illustrations (maps) in the text.

Professor Russell's report is designed to present available facts regarding four artesian basins in a section where a large area of public land awaits development, and where very much depends upon the available water supply. The geology of the section, as related to underground waters, is briefly outlined, after which springs and existing drilled wells in each basin are described. A brief discussion of the laws, or lack thereof, governing artesian waters is appended, and there is a short bibliography of literature on artesian wells.

Mr. Leighton's paper is a vast improvement upon his earlier one in this series, entitled "Sewage Pollution in the Metropolitan Area Near New York City." In that paper a rather futile attempt was made to estimate the financial losses due to sewage pollution in the section named. The present paper brings together many scattered facts and figures on the character of a number of important drainage systems in the Northeastern United States; including, the author states, "the important and readily available records of water examinations which have been carried on in this country, except those now being prosecuted in connection with the Chicago Drainage Canal and Illinois River."

The main drainage systems included are those of the Merrimac, Blackstone, Connecticut, Housatonic, Delaware and Ohio rivers. The general features of these rivers and their most important tributaries are given before questions of pollution and analyses of their waters are set forth. A brief introduction is employed to discuss the essential qualities of water for various uses, the impurities in natural waters and the interpretation of water analyses. The chief sources of information are the reports of the Massachusetts, Connecticut and Ohio state boards of health, and the reports by Mr. Allen Hazen and Mr. Geo. W. Fuller, respectively, on their water purification studies at Pittsburg, Louisville and Cincinnati.

ADMINISTRATION REPORT ON THE RAILWAYS IN INDIA.—By A. Brereton, Secretary to the Government of India, Public Works Department (Railways). Simla, India: Pub. Doc. Paper; 8½ × 13 ins.; pp. 438; map and diagrams. $1.

This annual report is for the year ending Dec. 31, 1902. The report proper occupies only about 24 pages, and reviews the traffic and financial conditions, new construction and projects, accidents, classification of employees, etc. The balance of the bulky volume is composed of detailed tabular statistics for the railway system and the individual railways. These include traffic, earnings and expenses; train, engine, car and ton mileage, train loads, fuel consumption; rolling stock, and its equipment with automatic brakes and gas light; signal equipment, classification of employees, accidents, railway schools (for children of employees), collieries and coal production, etc. There is also a summarized history of the individual lines, followed by tables of the principal railway bridges and tunnels.

THE MICHIGAN TECHNIC, 1903.—Ann Arbor, Mich: Engineering Society of the University of Michigan. Paper; 6 × 9 ins.; pp. 101; illustrated.

There are 15 papers in this annual. Among these are: "Some Phases of Hydraulics," by Prof. Gardner S. Williams, of Cornell; "Anchor Ice," by C. W. Hubbell (reprinted in Eng. News for Aug. 13); "Notes on Submerged Water Pipes," by G. H. Fenkell; "Why Engineers Should Advertise," by Geo. H. Gibson; and the "Present Status of the Steam Turbine," by J. R. Bibbins.

REPORT ON THE CAPE GOVERNMENT RAILWAYS, 1902.—By T. S. McEwen, General Manager. Cape Town, Cape Colony: Pub. Doc. Paper; 8 × 13 ins.; pp. 225; map and diagrams.

The general manager's report proper covers only about 25 pages, and is followed by the reports of the chief and district engineers, locomotive superintendents and traffic managers. Construction and maintenance accounts, traffic and financial statistics occupy nearly a hundred pages. There is also an interesting report by the Conservator of Forests upon the experimental plantations of trees for tie timbers.

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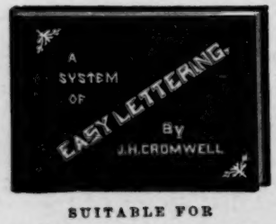

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DESIGN OF A HIGH-SPEED STEAM ENGINE.—Notes, Diagrams, Formulas and Tables. By J. F. Klein, Professor of Mechanical Engineering in Lehigh University. Second Edition, Revised and Enlarged. New York: D. Van Nostrand Co. Cloth; 6 × 9 ins.; pp. 237; 140 illustrations, including some figures on folding plates. $5 net.

THE DRAFTING OF CAMS.—By Louis Rouillion. New York: The Derry-Collard Co. Paper; 5 × 8 ins.; pp. 22; 16 figures in the text. 25 cts.

THE PRACTICAL GAS ENGINEER.—Covering errors to be avoided in the construction of, and How to Erect, Operate and Care for Gas and Gasoline Engines. By E. W. Longanecker, M. D., Anderson, Ind.: The Author. Cloth; 4 × 7 ins.; pp. 143; 2 illustrations. $1.

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